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LUMBAR SUPPORT

The present invention relates to a lumbar support, as can be incorporated into backrests of seats of all kinds, for example motor vehicle seats, for supporting the loin and spinal column region.

Known lumbar supports of the kind described above comprise at least one archable supporting element, which is called lumbar support basket or lumbar support plate and can consist of a wire-lattice or integral plastic injection moulding, for example. Furthermore, known lumbar supports comprise an adjustment mechanism, by means of which the curvature of the at least one archable supporting element of the lumbar support can be adjusted. An adjustment mechanism known from the prior art comprises a Bowden cable arrangement, wherein the sleeve of the Bowden cable arrangement is supported on an end section of the archable supporting element, while the wire of the Bowden cable arrangement displaceably mounted in the sleeve is attached at another end section of the archable supporting element, so that through movement of the wire in the sleeve of the Bowden cable arrangement the two end sections are moved nearer or further from one another, in order in this way to adjust the curvature of the supporting element. The wire in the sleeve of the Bowden cable arrangement can be adjusted either manually, for example, by means of a hand-wheel or automatically by means of a suitable motor drive.

Lumbar supports of the kind described above are used, for example, in backrests of motor vehicle seats. In this case, the lumbar supports carry out a multiple support function, since both the lower spinal column region, that is to say the loin or lordosis region, and the middle spinal column region and the upper spinal column region must be sufficiently supported, in order to reliably prevent fatigue symptoms when sitting over longer periods as well as possibly even damage to health. For this reason, the use of lumbar supports, the arching

or curvature of which can be adjusted, is of utmost importance, so that the curve apex can be adapted to the particular needs of the individual person. This not only applies to lumbar supports in motor vehicle seats, but is also valid for applications in backrests of seats of any kind, for example office chairs etc.

With the aid of conventional adjustable lumbar supports, a sufficient supporting functionality can be ensured in most cases as a result of a user adjusting the curvature of the archable supporting element of the lumbar support to his spinal column corresponding to his spinal column form.

The human spinal column, however, is formed in extremely individual ways. Therefore it may be the case that a convex curvature of the supporting surface, that is to say the archable supporting element, of the lumbar support is perfectly helpful and pleasant for one user, while the same curvature is unpleasant and possibly even harmful for another user. In particular, spinal column forms are also conceivable, where a convex curvature of the lumbar support may over the long term lead to substantial damage to health. Moreover, heed should be paid to the fact that the human spinal column deforms with increasing sitting duration, whereby furthermore with increasing sitting duration more robust support is necessary in the lordosis region of the individual user.

Consequently, in principle there is a need for a lumbar support, which takes account of the problems described above and permits greater flexibility and adaptability to the individual spinal column form, respectively the individual spinal column characteristics of the various users.

This object is achieved according to the invention by a lumbar support with the features of Claim 1. The sub-claims in each case define preferred and advantageous embodiments of the present invention.

The lumbar support according to the invention comprises at least one archable supporting element as well as an adjustment mechanism for adjusting the

curvature of the archable support element, wherein the adjustment mechanism is configured in such a manner that it not only allows a curvature of the archable supporting element in contrast to lumbar supports into a first curvature direction, in which the archable supporting element forms a convex supporting surface, but furthermore also a curvature into a second curvature direction, in which the archable supporting element forms a concave supporting surface. Therefore, the lumbar support according to the invention allows both a "positive" curvature and a "negative" curvature, so that the lumbar support, in comparison to conventional lumbar supports, can be substantially better adapted to the specific requirements of an individual user.

The adjustment mechanism advantageously is also configured in such a manner that the second curvature direction is aimed substantially opposite to the first curvature direction out of the plane of the laminar supporting element.

By using a circumferential Bowden cable system, it can be achieved that the curvature of the archable supporting element can be adjusted and adapted in both curvature directions with the aid of this circumferential Bowden cable system. Likewise, a mechanical adjustment mechanism is also conceivable, which engages the curving apex, respectively point of curvature of the archable supporting element and controls the curvature of the archable supporting element in both curvature directions, whereby such a mechanical adjustment mechanism can be implemented with the aid of a spindle drive, for example.

The adjustment mechanism according to the invention consists in principle of two adjustment means, whereby the first adjustment means bring about the curvature of the archable supporting element into the first curvature direction, while the second adjustment means bring about the curvature of the archable supporting element into the second curvature direction. The two adjustment means can be coupled with one another via a common actuating device. Furthermore, however, it is also conceivable to form the two adjustment means separately and divided from one another.

The adjustment means, for example, can be formed in each case by Bowden cable arrangements, wherein the sleeve of the first Bowden cable arrangement is supported on a first end section of the archable supporting element and the wire of the first Bowden cable arrangement working as a tensioning member acts upon a second end section of the archable supporting element, so that by adjusting the wire inside the sleeve of the first Bowden cable arrangement the two end sections are moved, in particular pulled closer or further from one another. Advantageously, the wire can be guided from the first end section via reversing means, in particular in the form of a reversing roller, to the second end section on and off back to the first end section and attached there to the archable supporting element, so that the curvature of the archable supporting element can therefore be adjusted into the first curvature direction more effectively and with less expenditure of energy. The wire of the first Bowden cable arrangement is preferably guided along the back of the archable supporting element. The sleeve of the second Bowden cable arrangement likewise can be supported on the first end section of the archable supporting element, whereby starting from this first end section the wire of the second Bowden cable arrangement is guided to the second end section and from there again via suitable reversing means back to the first end section and fastened here. In this case, the wire of the second Bowden cable arrangement preferably firstly runs along the back of the archable supporting element, the wire of the second Bowden cable arrangement then being guided through an opening in the archable support element to the front of the same and being reversed there. Subsequently, the wire returns through a further opening in the archable supporting element to the back of the same and from there is guided along the back to its fastening point on the first end section of the archable supporting element. This method of guidance also allows particularly effective arching of the archable supporting element into the second curvature direction with little expenditure of energy.

The reversing roller mentioned above can be pivotably attached to the second end section of the archable supporting element, whereby the reversing roller can be swivelled out of the plane of the archable supporting element, so that therefore the wire of the first Bowden cable arrangement can run as smoothly as possible with adjustment using as little expenditure of energy as possible.

The archable supporting element can comprise a first laminar supporting section and a second laminar supporting section, which are connected via at least one flexible longitudinal bar running in the longitudinal direction of the supporting element. The flexible longitudinal bar is configured in such a manner that it is flexible in the longitudinal direction of the supporting element, so that even if the lumbar support is abused, that is to say if the lumbar support is loaded to an unacceptably high degree, breakage or damage of the lumbar support is prevented due to the longitudinal flexibility of this longitudinal bar. For this purpose, the longitudinal bar can have in the longitudinal direction elevations and depressions in alternating succession in the form of a concertina, which in each case runs in the cross direction of the longitudinal bar. Preferably two such longitudinal bars are provided situated at a distance from one another in the lateral direction of the archable supporting element.

The adjustment mechanism of the lumbar support according to the invention can be operated both manually and motor-driven. In this case, it is possible that common actuating means are provided for adjusting the curvature of the archable supporting element both into the first curvature direction and into the second curvature direction, in such a manner that adjustment of the curvature into the first curvature direction at the same time actively contributes to a reduction of the curvature in the second curvature direction and vice versa, so that with little expenditure of energy effective adjustment of the curvature of the lumbar support according to the invention is possible in both curvature directions.

The lumbar support can be associated with a further adjustment mechanism for adjusting the archable supporting element along guidance means, for example guide rods, whereby with the aid of this further adjustment mechanism, which likewise can be configured in the form of a Bowden cable arrangement, in particular in the form of a circumferential Bowden cable system, vertical adjustment of the lumbar support in a backrest of a seat is possible. For this reason, the sleeve of the Bowden cable arrangement can be supported on a mounting plate coupled with the guidance means, while the wire of the Bowden cable arrangement is coupled with the archable support element, preferably via a spring element. Also, in respect to the vertical adjustment of the lumbar support, two separate Bowden cable arrangements can be provided for adjusting the archable supporting element into a first longitudinal direction along the guidance means, respectively for adjusting the archable supporting element into a second longitudinal direction opposite the former along the guidance means, whereby if a circumferential Bowden cable system is used, the two Bowden cable arrangements can be coupled with one another in such a way that tensioning the one Bowden cable arrangement at the same time leads to relaxing the other Bowden cable arrangement and vice versa.

The lumbar support according to the invention is suitable for use in backrests of motor vehicle seats or office chairs, but without being limited to this preferred scope of application. In principle, the lumbar support according to the invention can be used wherever individual and reliable as possible support of the spinal column, in particular the loin or lordosis region of the spinal column of a user is wanted. Thus, for example, incorporation of the lumbar support according to the invention is also conceivable in therapeutic cushions, mattresses or similar.

The archable supporting element of the lumbar support according to the invention is preferably produced as a plastic integral laminar part, whereby however the invention can also be applied to lumbar supports with multi-part archable supporting elements and in particular also to lumbar supports with lattice mats as archable support elements or similar.

The present invention is described in detail below with reference to the drawing on the basis of a preferred embodiment.

Fig. 1 shows a top plan view of the back of a lumbar support according to a preferred embodiment of the present invention,

Fig. 2 shows a top plan view of the front of the lumbar support shown in Fig. 1 and

Fig. 3A and Fig. 3B show a comparison between the curvature attainable with conventional lumbar supports and the curvature attainable with the aid of the present invention.

In Fig. 1, a lumbar support is illustrated according to a preferred embodiment of the present invention, wherein a back view is shown.

The lumbar support comprises an archable supporting element, which dependent on the actual embodiment is also described as a lumbar support plate or a lumbar support basket. The archable supporting element comprises a first laminar supporting section 1 and a second laminar supporting section 2, it being possible to make the two supporting sections 1, 2 out of plastic in each case. The supporting sections 1, 2 are connected with one another via longitudinal bars 3, which can be formed integrally with the supporting sections 1, 2 or can be fastened to them in an arbitrary way. The longitudinal bars 3 in each case are strip-like in shape and have a wave- or concertina-like structure in such a manner that in the longitudinal direction they have elevations and depressions in alternating succession and are thus flexibly formed. Due to this configuration, the longitudinal bars 3 are flexible in the longitudinal direction in such a manner that when the supporting sections 1, 2 are loaded to an excessively high degree, that is to say in a so-called case of abuse, they allow flexible resilience of the entire lumbar support, since they can be compressed

dependent on the load to a greater or lesser degree due to the elevations and depressions in alternating succession. At the same time, however, the longitudinal bars 3 are configured in such a manner that they provide a sufficiently high degree of rigidity of the lumbar support in respect to a normal load regardless of their longitudinal flexibility. In principle, only a longitudinal bar 3 of this kind or more than two longitudinal bars 3 of this kind can also be provided between the two supporting sections 1, 2.

The supporting sections 1, 2, which serve as an archable supporting element and on their front provide a resting or supporting surface for a person leaning against it, are displaceably mounted along rods 4, which can be curved as shown in Fig. 1. If the lumbar supports as illustrated in Fig. 1 are used in a backrest of a seat, these rods 4 run in the vertical direction of the backrest, so that by adjusting the supporting sections 1, 2 along the rods 4 the vertical position of the lumbar support in the backrest can be adjusted. For this purpose, a first tie bar 5 made of metal, which is attached to the rods 4 is provided for example. Furthermore, a second tie bar 6, also made of metal can be provided, which is attached above the first tie bar 5 to the rods 4. A first Bowden cable is supported with its sleeve 18 as shown in Fig. 1 on the lower tie bar 5, while the wire 19 of this first Bowden cable runs under the tie bar 5, respectively through the tie bar 5 and is coupled with a coil spring 20, which is again attached to an upper end section of the supporting section 1 and is hung in there for example (see reference numeral 23 in Fig.1). A second Bowden cable is supported with its sleeve 21 on the upper tie bar 6, whereby the wire 22 of this second Bowden cable, which is displaceably mounted in the sleeve 21, runs under the tie bar 6, respectively through the tie bar 6, and is likewise fastened adjacent the fastening point of the coil spring 20 on the upper end section of the supporting section 1. In the case of the embodiment illustrated in Fig. 1, guides 7 are attached to the supporting section 1, through which the rods 4 run, so that the supporting section 1 can be moved with the supporting section 2 attached to it via the longitudinal bars 3 over the guides 7 along the rods 4.

From the illustration of Fig. 1, it is evident that by tensioning the first Bowden cable 18, 19, the supporting sections 1, 2 can be moved downward along the rods 4, while by tensioning the second Bowden cable 21, 22 the support sections 1, 2 are moved upward along the rods 4. According to a preferred embodiment, the two Bowden cables in particular form a circumferential Bowden cable system in such a manner that a common actuating device is provided for both Bowden cables, as this is indicated in Fig. 1 on the basis of an actuating device 24, which is coupled both with the first Bowden cable and with the second Bowden cable. This actuating device 24 is formed in the case of the embodiment illustrated in the form of a motorized worm gear drive, whereby the two Bowden cables are coupled with the actuating device 24 in such a manner that tensioning the wire 22 inside the sleeve 21 at the same time leads to relaxing the wire 19 inside the sleeve 18 and vice versa, so that with the aid of the actuating device 24 in a simple, effective and energy-saving way it is possible to vertically position the lumbar support exactly along the rods 4 .

Furthermore, the lumbar support shown in Fig. 1 comprises an adjustment mechanism, so that the curvature of the supporting sections 1, 2 can be substantially adjusted in two opposing curvature directions, in order that the resting or supporting surfaces of the supporting sections 1, 2 can assume both a convex and a concave form in relation to the back or spinal column region of a person leaning against it.

This will be described in detail below on the basis of Fig. 3, whereby in Fig. 3A various curvatures attainable with the aid of a conventional lumbar support are illustrated. As shown in Fig. 3A, the conventional lumbar support can be curved exclusively into a curvature direction out of the plane defined by the archable supporting element 1, 2 in the unarched condition, whereby the curving apex is always moved towards the back of the individual person, so that the archable supporting element 1, 2 in the curved condition assumes a convex resting or supporting surface. As illustrated in Fig. 3B, the lumbar support according to the invention is no longer restricted to the convex curvature described above, but

equally a curvature of the archable supporting element 1, 2 into the opposite curvature direction can be brought about in such a manner that the curvature apex is moved away from the person leaning against it in each case, so that the archable supporting element forms a concave resting or supporting surface.

The adjustment mechanism of the lumbar support illustrated in Fig. 1 for achieving the curvature of the supporting sections 1, 2 into the two curvature directions is composed in principle of two separate adjustment mechanisms, whereby the one adjustment mechanism is provided for controlling the conventional convex curvature, while the other adjustment mechanism serves to control the concave curvature. Both adjustment mechanisms are implemented in the case of the embodiment illustrated in the form of Bowden cable arrangements, whereby naturally other arrangements deviating from this, for example with the aid of a spindle drive or similar, are also conceivable.

The adjustment mechanism provided for the convex curvature as in the case of conventional lumbar supports is substantially arranged and effective at the back of the lumbar support. With the embodiment illustrated, this adjustment mechanism comprises a Bowden cable, the sleeve 8 of which as shown in Fig. 1 adjacent the upper end section of the supporting section 1 is supported on a socket or similar, whereby the wire 9 of this Bowden cable displaceably mounted in the sleeve 8, as also shown in Fig. 1, is guided downward from the upper end section of the supporting section 1 to a reversing roller 11. The reversing roller 11 is pivotably attached via a bracket 12 to a lower end section of the supporting section 2 (see reference numeral 13), so that the reversing roller 11 with the bracket 12 is held variably in relation to the supporting section 2 (and in relation to the supporting section 1) in such a manner that the angle enclosed between the bracket 12 and the supporting sections 1, 2 is variable. As a result of the pivotability of the reversing roller 11, it is ensured that during operation of the lumbar support and when the Bowden cable 8, 9 is manipulated, the reversing roller 11 can always assume the optimum position for maximum transfer of force and minimum friction. As a result of the reversing

roller 11, the wire 9 as again shown in Fig. 1 is guided back to the upper end section of the supporting section 1, where the wire 9 is finally fastened in a suitable way (see reference numeral 10).

From the above description, it is clearly evident that by tensioning the wire 9 with the aid of the Bowden cable, the lower end section of the supporting section 2 can be moved toward the upper end section of the supporting section 1, so that dependent on the degree of tensioning of the wire 9 the desired convex curvature of the supporting sections 1, 2 is achieved, as illustrated as an example on the left of Fig. 3B. It is to be noted that the fronts of the supporting sections 1 and 2, not visible in Fig.1, represent the convexly bent, respectively curved supporting, respectively resting surfaces for the lordosis region.

The adjustment mechanism for the concave curvature of the supporting sections 1, 2 likewise comprises a Bowden cable arrangement, wherein the sleeve 14 of this Bowden cable arrangement just as the sleeve 8 of the other Bowden cable arrangement is supported at the upper end section of the supporting section 1 on a socket or similar. The wire 15 of this Bowden cable arrangement starting from the upper end section of the supporting section 1 runs downward firstly along the back of the upper supporting section 1, whereby between the lower end section of the supporting section 1 and the longitudinal bar 3 attached to it on the right in Fig. 1 an opening is formed, so that the wire at the lower end section of the supporting section 1 can pass out at the front of the supporting section 1 and the corresponding longitudinal bar 3.

As can be seen in Fig. 2, which illustrates a frontal view of the lumbar support of Fig. 1, the wire 15 starting from this opening runs along the front of the longitudinal bar 3 to the lower supporting section 2, where it is guided by reversing means 17 in the lateral direction of the supporting section 2 firstly to the other longitudinal bar 3 and then along the front of the other longitudinal bar 3 again to the lower end section of the supporting section 1. Also between this other longitudinal bar 3 and the lower end section of the supporting section 1 an

opening is formed, so that the wire 15 can be again guided back through this opening to the rear of the supporting section 1.

As shown in Fig.1, starting from this opening the wire 15 runs back again between the lower end section of the supporting section 1 and the longitudinal bar 3 on the left in Fig.1 to the upper end section of the supporting section 1, where it is attached or fastened in a suitable way (see reference numeral 16).

The reversing means 17 shown in Fig. 2 are preferably formed as flat as possible, since the front of the supporting section 2 concerns the resting or supporting surface for the lordosis region of the person leaning against it. In principle, it suffices if the reversing means 17 - as shown in Fig. 2 - concern a narrow cap, which is attached on the front of the lower supporting section 2, so that the wire 15 can be guided in the desired direction in a relatively narrow gap between this attachment and the top side of the lower supporting section 2 along a guide channel or guide groove.

From the above explanation of Fig. 1 and Fig. 2 as well as the illustrations of Fig. 1 and Fig. 2 it is clear that when the wire 15 is tensioned, that is to say when the wire 15 is pulled back into the sleeve 14, the lower supporting section 2 will move forwards to approach the upper supporting section 1 in Fig. 2, so that dependent on the degree of tensioning of the wire 15 the fronts of the supporting sections 1 and 2 represent a concave resting or supporting surface pronounced to a greater or lesser degree for the person leaning against it.

Preferably, the two Bowden cables 8, 9 or 14, 15, which are provided for the convex, respectively concave curvature of the archable supporting element comprising the two supporting sections 1, 2 (as well as the two longitudinal bars 3), similar to the Bowden cables 18, 19, or 21, 22 provided for the vertical adjustment, form a circumferential Bowden cable system in such a manner that tensioning of the one Bowden cable at the same time accompanies a relaxing of the other Bowden cable and vice versa. The two Bowden cables 8, 9 or 14, 15

can therefore - as indicated in Fig. 1 - be coupled with a common actuating device 23, for example in the form of a motorized worm gear drive, similarly to the actuating device 24, whereby the actuating device 23 is configured in such a manner that when the wire 9 is pulled from the sleeve 8 by the actuating device 23 the wire 15 can substantially to the same extent slide back into the sleeve 14 and vice versa. In this way, with the aid of only one actuating device infinite alternation according to the needs of the individual user and with little expenditure of energy is possible between a conventional convex curvature of the supporting sections 1 and 2 as well as of the longitudinal bars 3 in-between these and a concave curvature with individual adjustment of the degree of curvature in each case.